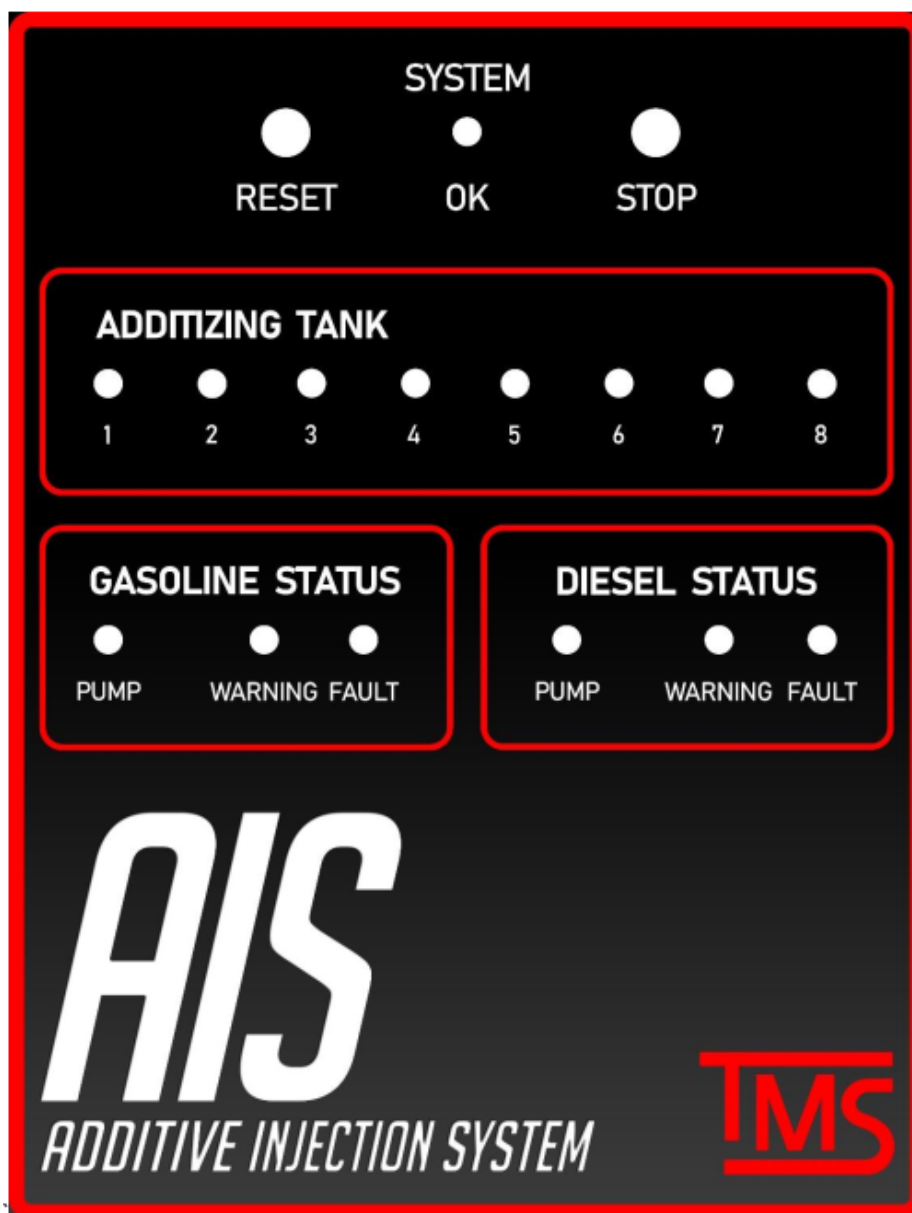




Additive Injection System (AIS)

Service Manual

Version 4, June 2022



Total Meter Services Inc., 70 Worcester Rd., Toronto, Ont., M9W 5X2, tmsautomation.com

NOTICE

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Additive Injection System (AIS)

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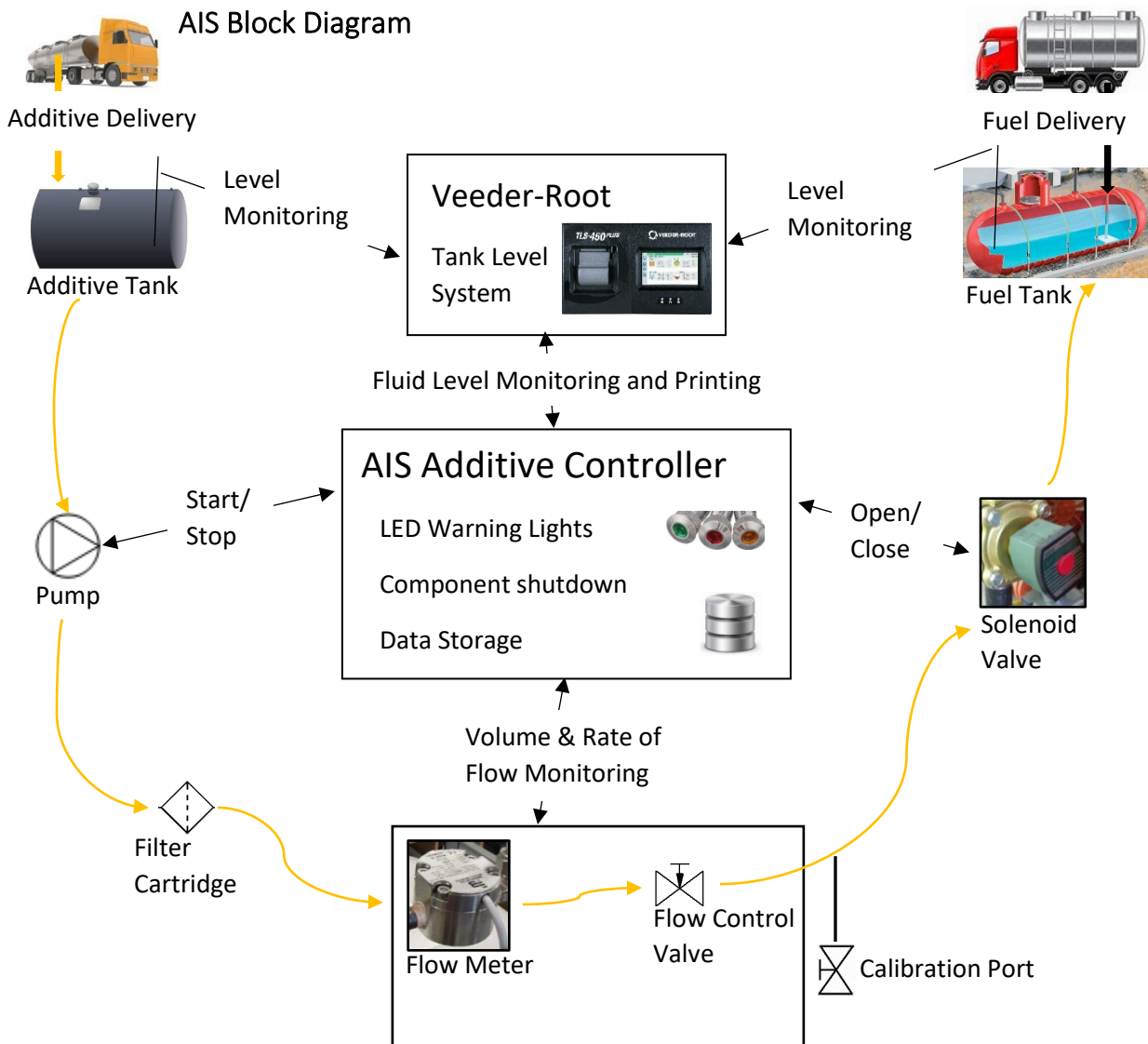
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Additive Injection System (AIS)

INTRODUCTION

The TMS Additive Injection System (AIS) uses a combination of mechanical and electrical components and custom software, to optimize the conventional additive blending procedure applied to gasoline and diesel fuels. These refinements automate the blending procedure, saving the retailer significant amounts of money, time and most importantly, improving the quality of blended fuel for the customer. The main controller in the AIS is the modular PC, and the main I/O is controlled via relays.





Additive Injection System (AIS)

PURPOSE OF DOCUMENT

This manual covers the service procedures and technical troubleshooting of the TMS Additive Injection System (AIS) including;

- Safety considerations
- Network Connections to the AIS
 - Changing device IP
 - TeamViewer configuration
 - VNC Configuration
- Navigating the AIS interface
 - System icons
 - Interface screens
- System Calibration
 - Using the built-in AISConfig utility
 - Relay assignment charts
- Service
 - Procedural considerations
 - Equipment-specific service information
 - Using the AIS Check feature
 - Using the Diagnostics feature
 - Built-in service mode
 - Line purging
- Appendix
 - Quick troubleshooting guide for faults
 - Contact TMS



Additive Injection System (AIS)

SAFETY

It is important for everyone on the project to make safety a priority! Read all relevant Operation and Maintenance Manuals and ensure a thorough understanding of all procedures and safety requirements before starting work. Note that specialized skill sets may be required for service of this system (e.g. working in a confined space, electrician, pipe fitter). Confirm that the service team members have the appropriate qualifications, if necessary, for each task before beginning the project.

Most incidents are caused by failure to observe basic safety rules and precautions. Recognizing possible hazards before acting will help to create a safe work environment. Ensure that the project site is identified with hazard pylons and follow appropriate confined space precautions when working in sumps.

The labels on equipment and information located in this document are NOT inclusive. All personnel MUST be satisfied that any procedure is safe for themselves and others. All personnel must also ensure that procedures do not compromise the safety or function of equipment for future use. If in doubt, it is the responsibility of the individual performing service to obtain clarification from a supervisor or manager.

In general:

- Always focus on the job at hand
- Obey all warning labels
- Replace unreadable or missing labels with new ones before operating equipment
- Do not block burst hoses, pipes or fittings with hands. Fluids under pressure can penetrate skin and cause serious injury
- Do not touch hot surfaces
- Always wear the task specific, recommended, personal protective equipment (PPE). Protective clothing can include a hard hat, safety glasses, ear protection, close fitting clothes, steel toed boots, gloves and a high visibility vest
- Follow the recommended site-specific steps to ensure safe off loading of fuel
- Do not smoke on the project site.
- Never use unauthorized containers for fluid storage or transfer
- Do not attempt to overfill storage tanks
- In the event of a spill, follow site-specific cleanup guidelines



Additive Injection System (AIS)

NETWORK CONNECTIONS

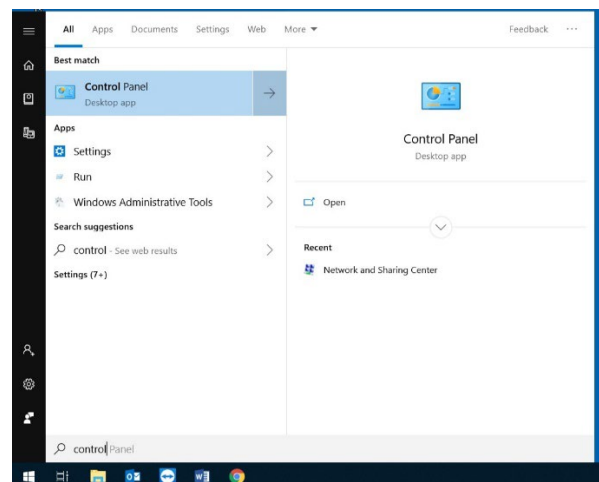
Modifying the IP of a Device

To troubleshoot the additive Injection System (AIS) it may be necessary to configure the IPv4 settings of either or both ethernet ports on the AIS controller, as well as the device used by the technician to connect to the controller. The steps to access and configure the IPv4 settings on a windows 10 device are as follows:

1. Access the network and sharing center
2. Change the network adapter settings as required
3. Verify the network settings

***Note:** the steps listed below are for modifying the network on a Windows 10 device. Older or different versions of Windows will have different procedures to access the adapter settings. Consult your IT department, or TMS for assistance. For sites where a customers internal network will be used, contact the IT department of the client for all network info.

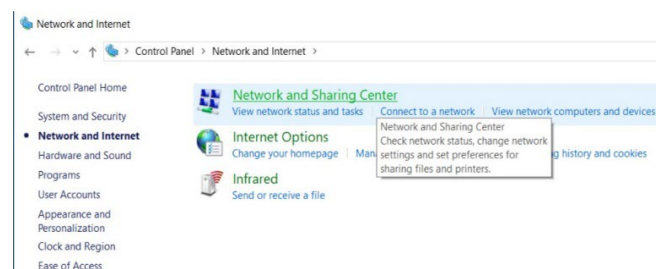
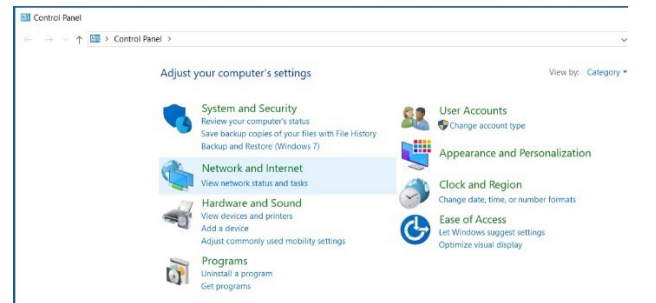
Step 1: In the Start menu search bar, type “Control panel”, and click the icon when it appears.



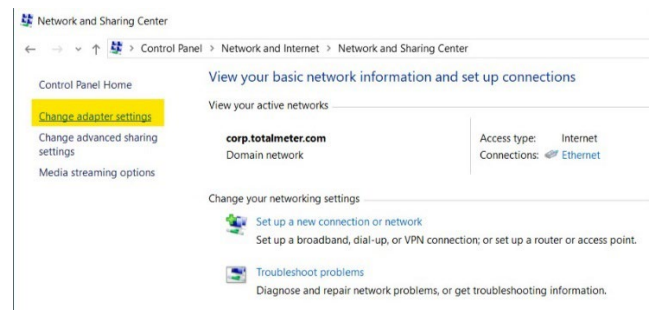


Additive Injection System (AIS)

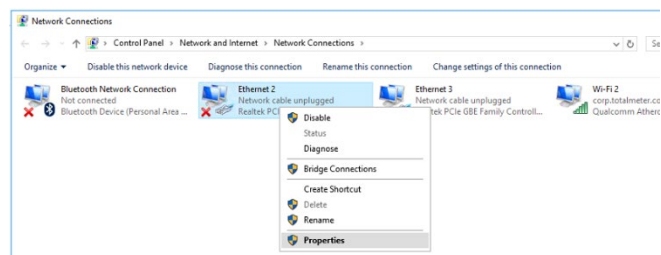
Step 2: In the control panel, locate and select Network and Internet. Next, Select Network and Sharing Center to bring up the connection status screen.



Step 3: In the left hand menu, select “Change adapter settings”, as highlighted. This will show all installed adapters on the current device.



3.1) If you are changing a laptop’s IP to connect to the AIS, right click on the ethernet adapter and select “properties”.

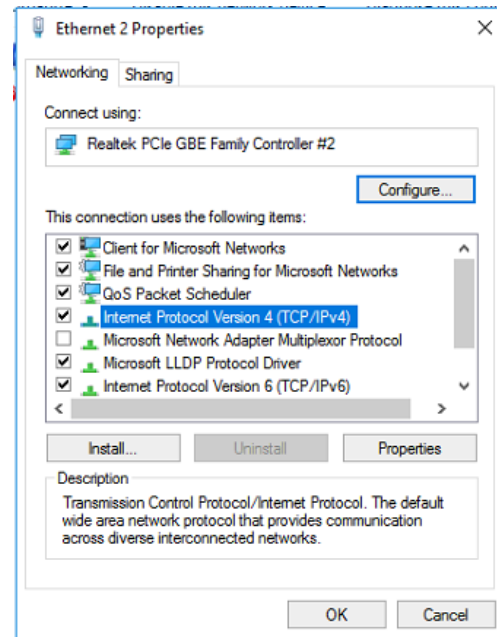


3.2) If you are modifying the IP address on the AIS, right click either wireless OR ethernet adapter 2 as required and then select “properties”.



Additive Injection System (AIS)

Step 4: Scroll down the list to “IPv4” and click it once to highlight it. Then, click “properties” to access the IP address settings.



Step 5: Use the following settings, depending on the device being changed:

5.1) AIS: The AIS has 2 built-in LAN ports on the computer box, as well as a wireless adapter for Wi-Fi connection.

The default settings are:

Ethernet 2:

IP- 192.168.1.52

Netmask- 255.255.255.0

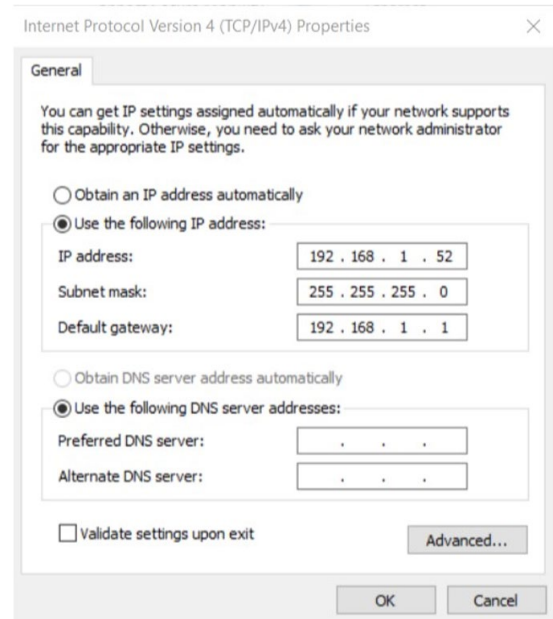
Ethernet 3:

IP- 192.168.1.51

Netmask- 255.255.255.0

Wireless* (if adapter is present)

The wireless connection should be set to “obtain an IP automatically” instead of a manual entry. Verify that this setting is checked.



**Note: The wireless adapter option may not be present on the system if no adapter is installed. If there is no wireless adapter, ignore this step.*



Additive Injection System (AIS)

**Attention: record the settings of your laptop/computer's initial settings before changing the IP, so that it can be returned to default after disconnecting from the AIS.*

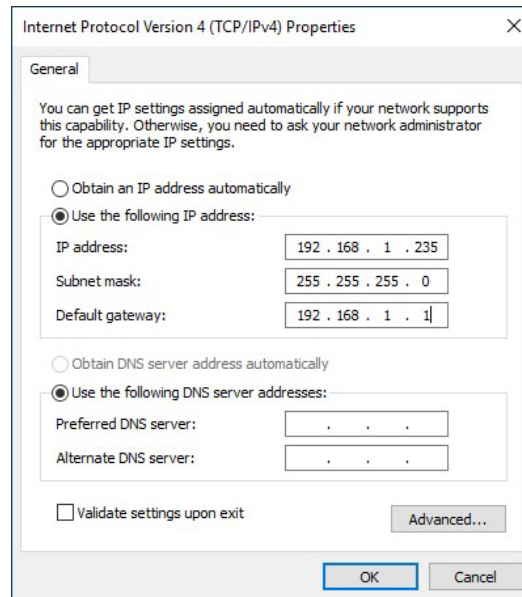
5.2) Laptop / External Computer:

Change the port you are connecting to a cable so that it matches the following:

IP- 192.168.1.235

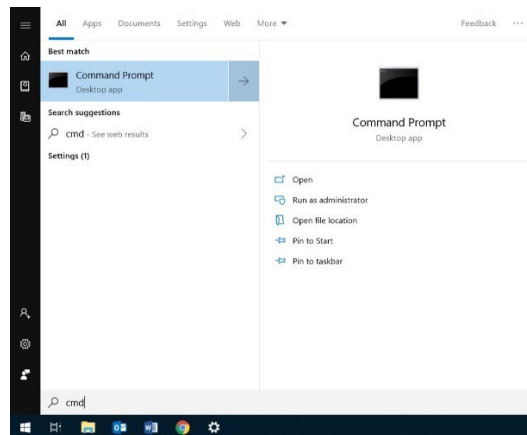
Netmask- 255.255.255.0

Gateway- 192.168.1.1

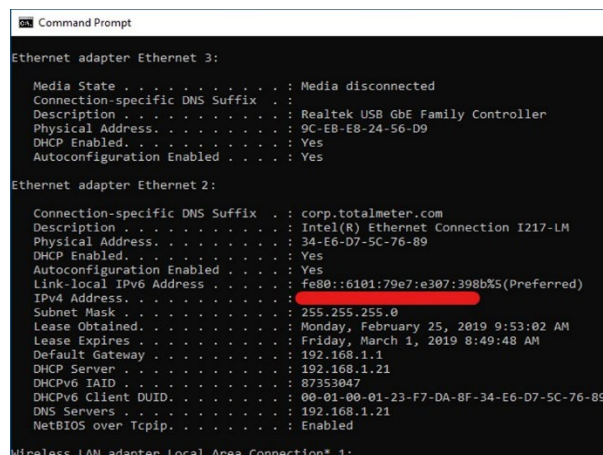


Step 6: Verify network settings

After configuring network settings, it is good practice to verify that all adapter settings are correct. To do this, open the command prompt by searching for “CMD” in the start menu search bar and selecting the command prompt.



Next, in the prompt, type in “ipconfig /all” without quotation marks, and press enter. This will display all adapters on the current machine, and all their settings. Make sure that the network adapter IPv4 addresses match what was entered.





Additive Injection System (AIS)

To make sure that the AIS and the Laptop are on the same network and have compatible configuration, it is good practice to send a “ping” command to the AIS controller from the laptop. To do this, make sure that the AIS and the Laptop are both plugged into the network, and that the Laptop IPv4 settings have been configured for the address of the local network. Next, open the command prompt on the laptop as outlined previously.

From the command prompt on the laptop, type “ping 192.168.1.51” if the AIS is connected to internet via port 1, and “ping 192.168.1.52” if it is connected to port 2. If it is successfully connected, the command prompt text will indicate a “reply” from the device with a “TTL” value. If the settings are incorrect, or the device is not connected to the network, the prompt will indicate that either the destination host is unavailable, or that the request has timed out. If the ping command is unsuccessful, the IP settings and physical connection will need to be checked and corrected.

The picture below shows an example of a successful ping command, and a failed ping command to devices on the network.

```
H:\>ping 192.168.1.52

Pinging 192.168.1.52 with 32 bytes of data:
Reply from 192.168.1.52: bytes=32 time=2ms TTL=128
Reply from 192.168.1.52: bytes=32 time=1ms TTL=128
Reply from 192.168.1.52: bytes=32 time=1ms TTL=128
Reply from 192.168.1.52: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.52:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms
```

```
C:\Users\User>ping 192.168.1.51

Pinging 192.168.1.51 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.51:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\User>
```



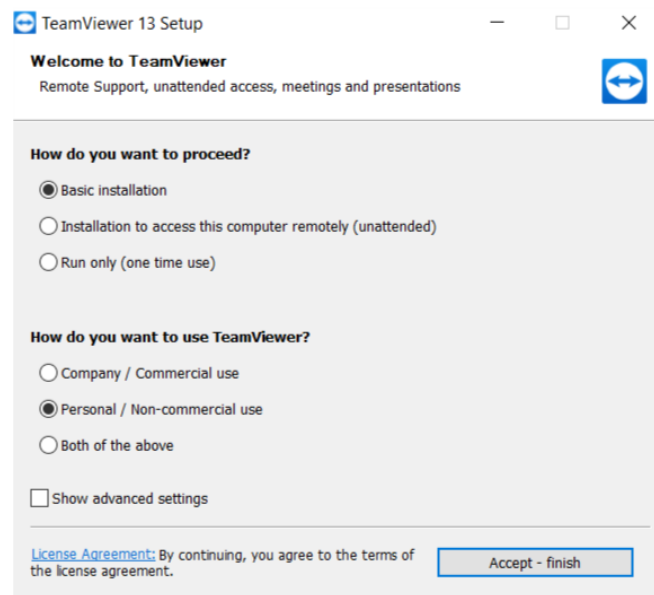
Additive Injection System (AIS)

Teamviewer Configuration

Step 1: Make sure that the device has **Teamviewer** installed already. If it is not already installed, go to <https://www.teamviewer.com/en/download/> and make sure that you download and install TeamViewer. *Note: the default installation is Teamviewer 13, a newer version is NOT required.* If connecting via a laptop to view the AIS, the laptop must also have TeamViewer installed and set up.

To install TeamViewer, run the TeamViewer_Setup.exe file downloaded from the link above, and follow the prompts. Select the “Basic Installation”, and “Personal/Non-Commercial use” options from the installation screen, and then click on “Accept – finish” to complete the installation process.

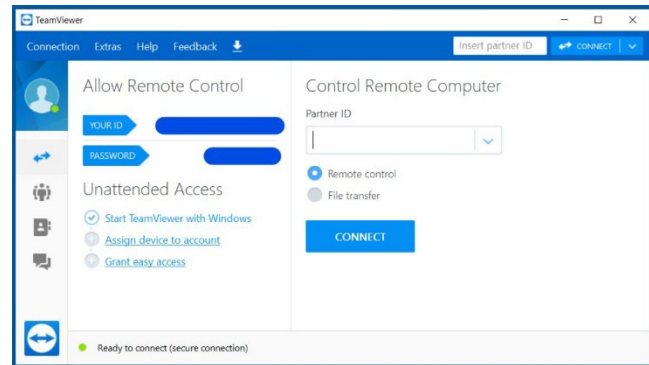
Once installed, TeamViewer will run on startup of the device it is installed on. This can be disabled within the settings under the “Extras” menu tab in TeamViewer.



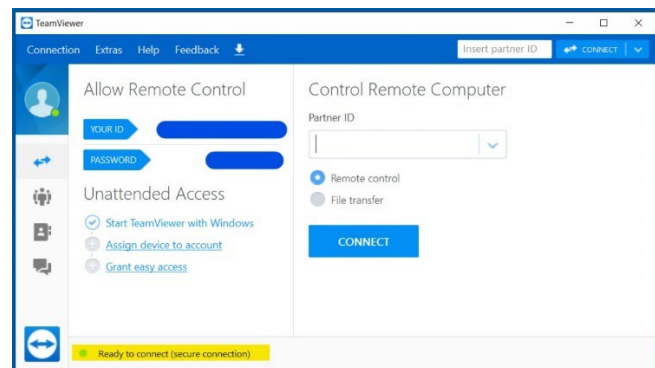


Additive Injection System (AIS)

Step 2: Open Teamviewer and make note of the “Your ID” field. Record this number for reference.



Step 3: Check the Teamviewer server connection status in the bottom left corner of the Teamviewer window. The icon should be a green circle with “Ready to connect” if you are connected to a wireless hotspot or will display “Only LAN Connections are possible”. If the icon is red or yellow, check network settings and verify that there is connectivity to the outside network.

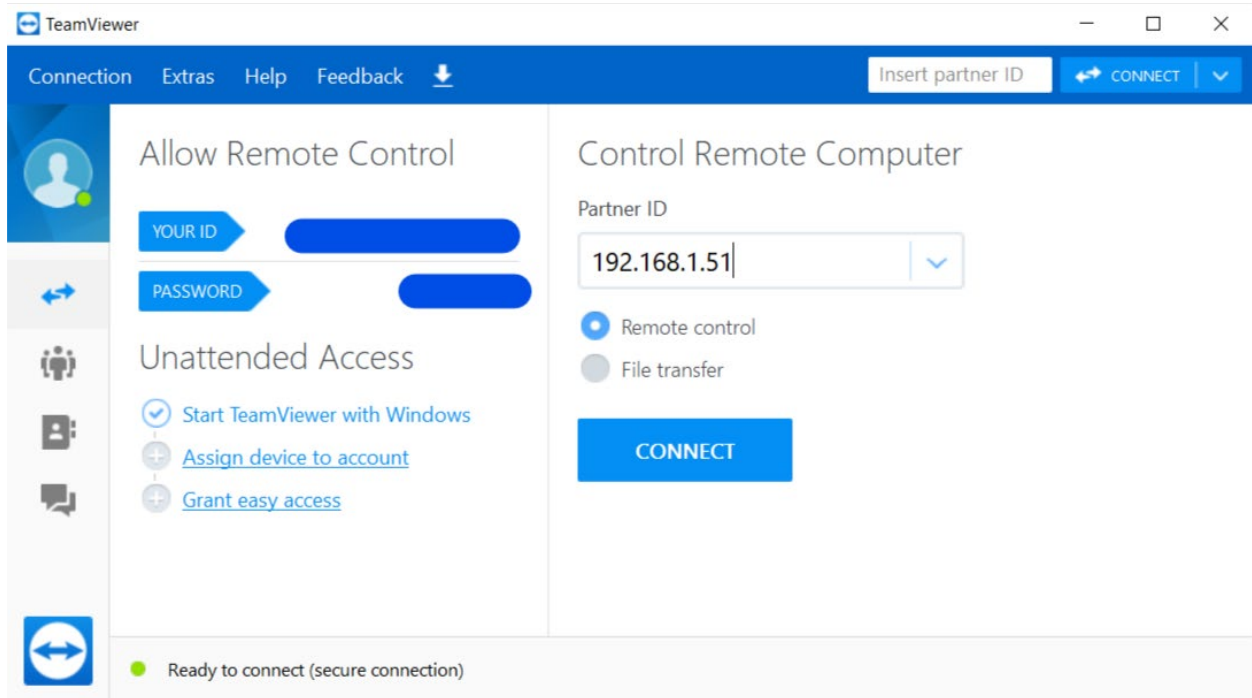


● Only LAN connections are possible



Additive Injection System (AIS)

Step 4: to connect to the AIS using teamviewer, in the “partner ID” field type in the IP address of the AIS network port that the ethernet cable is connected to. Click “connect” and teamviewer will open a new window to the AIS desktop. The remote desktop can be used exactly like a regular desktop. The default connection password is 6697010 for version 13 or older, and TM\$6697010 for newer versions of teamviewer.



**Note: Incorrect AIS Network settings will render the device inaccessible remotely, and will terminate the Teamviewer session.*

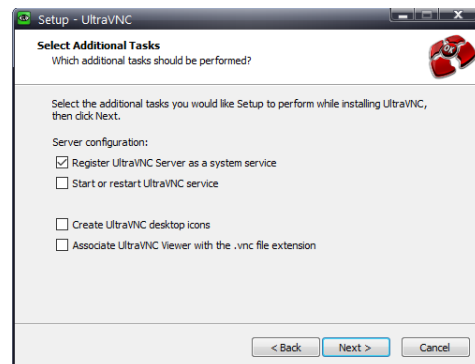
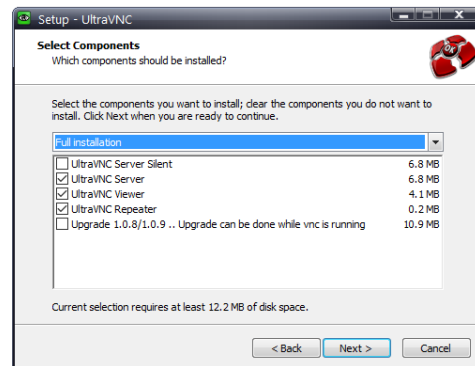


Additive Injection System (AIS)

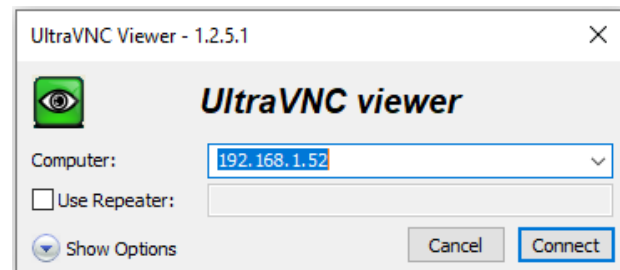
VNC Configuration

Step 1: Make sure that the device has UltraVNC installed already. If it is not already installed, go to <https://www.uvnc.com/downloads/ultravnc.html> and install the latest version. If connecting via a laptop to view the AIS, the laptop must also have VNC installed and set up.

To install UltraVNC, run the UltraVN_Setup.exe file downloaded from the link above, and follow the prompts. Leave the default options selected from the installation screen, and then click on “Next” to complete the installation process.



Step 2: To connect to the AIS using UltraVNC, open UltraVNC and enter the IP address of the AIS computer and press “Connect”.



**Note: Incorrect AIS Network settings will render the device inaccessible remotely, and will terminate the UltraVNC session.*



Additive Injection System (AIS)

NAVIGATING THE AIS INTERFACE

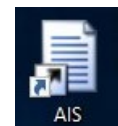
The AIS interface is made up of several key applications:

- AIS Utility
- TLS Utility
- AIS Config and Calibration Utility

It is important to be familiar with each application and their functions, as explained below.

AIS Utility

**Note: AIS Software interface may look different based on the version installed.*



The AIS utility always runs in the background while the unit is powered on and gives a window that displays all internal logic of the AIS as it operates. It automatically launches the TLS Utility on startup.

It indicates pump runs, solenoid operation, delivery volume, additive volume, additive pulses, and target blend percentage. It constantly polls the TLS utility to ensure volume data is being captured. The AIS Utility also contains information about the Check Process, Diagnostics process, and will indicate if the system is put into service mode (these are explained in the Service section starting on page 21). The utility keeps track of transactions and will create the transaction tickets at the end of each delivery.

Additive Injection System (AIS)

Clicking on the AIS window will cause it to enter select mode, indicated by the file path changing to “Select TMSAdditiveSystem” and will cause the AIS to pause. To restore functionality, press the enter key, and the file path will return to normal.

```
Select TMSAdditiveSystem - Shortcut
new required additive = 0.00281510471760125
batch additive = 0.01242911542639
current blending percentage =100.1

3/4/2019 2:25:19 PM    Inject Tank Id = 1
```

TLS Utility

The TLS Utility functions to constantly poll the TLS system, and monitors tank volume and delivery volume to ensure that the AIS continually monitors the blend recipe and dispenses additive at a regular interval during product offload, to ensure a consistent product mixture at all times.

The utility window indicates connection status to the TLS system, polling the device every second and returning status. It is used by the AIS Utility to monitor volumetric data.

The TLS Utility must be running for the AIS Utility to function. It will automatically start when the AIS utility is run. If it is not running, or if the AIS utility has crashed, restart both utilities by running the “AIS” shortcut from the desktop. It will automatically open a window to both utilities and attempt to connect to the TLS and begin calculating additive levels.

If the TLS is not connected to the system or has crashed, the TLS utility will indicate that the socket operation has failed to reach the target network device. This can be fixed by reconnecting the TLS or resetting the TLS. If the TLS Utility is still not functioning, reset power to the AIS and wait for it to reboot.

```
C:\Users\User\Desktop\TLS Utility Repository\TLS Utility 1.0.1.26\TLS Utility.exe
3/4/2019 3:10:59 PM Query_Command_i201
3/4/2019 3:11:00 PM Query_Command_i201
3/4/2019 3:11:00 PM Query_Command_i201
3/4/2019 3:11:01 PM Query_Command_i201
3/4/2019 3:11:01 PM Query_Command_i201
3/4/2019 3:11:03 PM Query_Command_i201
3/4/2019 3:11:04 PM Query_Command_i201
3/4/2019 3:11:05 PM Query_Command_i201
3/4/2019 3:11:06 PM Query_Command_i201
3/4/2019 3:11:06 PM Query_Command_i201
3/4/2019 3:11:07 PM Query_Command_i201
3/4/2019 3:11:08 PM Query_Command_i201
```

[illegible]



Additive Injection System (AIS)

AIS Configuration and Calibration Utility

AISConfig is an application used for troubleshooting and testing the configuration of the AIS relay board output, as well as for calibrating the additive meter when used in conjunction with a certified prover.



Configuration

When opened, AISConfig shows the current relay configuration, relay timer settings, solenoid settings, meter factor, and allows for toggling individual relays to test pump starts, solenoids, and AIS indicator lights. If the system is single meter (gasoline only) there will be 8 relays, and if the system is dual meter, there will be 16 relays. Below or in the troubleshooting section for relay assignments.

Clicking on the ON/OFF button on each relay under the “status” column will change the output status and toggle the relay. “Status” indicates the current output status of the relay. “Condition” indicates the enable/disable status of the indicated component. Meter factor is determined during calibration and cannot be manually edited.

**Note: there is a delay of approximately 1 second when toggling relay status*

TMS AIS Configuration and Calibration Utility

Configuration Calibration Manual Addition Logs Help

Relay				Solenoid				Pump				
Relay ID	Relay Number	Bank Number	Status	ID	Condition	Close Time Out	Energized Time Delay	Relay ID	ID	Relay ID	Condition	Running
1	1	1	Off	1	<input checked="" type="checkbox"/>	13000	10	1	1	5	<input checked="" type="checkbox"/>	Off
2	2	1	Off	2	<input checked="" type="checkbox"/>	13000	10	2			<input type="checkbox"/>	
3	3	1	Off	3	<input checked="" type="checkbox"/>	13000	10	3				
4	4	1	Off	4	<input checked="" type="checkbox"/>	13000	10	9				
5	5	1	Off		<input type="checkbox"/>							
6	6	1	Off									
7	7	1	Off									
8	8	1	Off									

Meter				Relay Timers						
Meter ID	Meter Factor	Condition	No Pulse Time Out	Pulser Channel	ID	Relay ID	Timer Number	Seconds	Minutes	Hours
1	0.0006517727...	<input checked="" type="checkbox"/>	100	0	1	5	1	10	0	0
		<input type="checkbox"/>			2	7	2	10	0	0
					3	8	3	10	0	0

Save Cancel



Additive Injection System (AIS)

Relay Assignments

Single meter:

1	Tank 1
2	Tank 2
3	Tank 3
4	Tank 4
5	Pump 1
6	TLS Fault
7	Sys OK/Fault
8	Warning

Dual Meter:

1	Tank 1
2	Tank 2
3	Tank 3
4	Tank 4
5	Pump 1
6	Fault (product 1)
7	Warning (product 2)
8	Tank 5
9	Tank 6
10	Tank 7
11	Tank 8
12	Pump 2
13	TLS Fault
14	Fault (product 2)
15	Warning (product 2)
16	System OK



Additive Injection System (AIS)

Calibration

- The Calibration units are defaulted to Liters. When calibrating in Gallons, ensure the Convert to Gallons is checked.
- Use the calibration line with ball valve from the AIS meter to control flow into the calibration beaker. The beaker is incremented in 10 mL markings up to 1000 mL.
- Once calibration line, ball valve closed and beaker are setup, press the green Start button.
- Wait a few seconds to ensure the meter does not creep. If the meter does creep, press the Stop to clear out, then press Start again.
- Once the Measure Volume holds steady open the calibration line ball valve.
- Fill the beaker to at least 3/4 full to ensure that there is sufficient volume to compare to the meter reading.
- Once ball valve is closed, press the red Stop button.
- Read the volume on the beaker and enter it into the Prover Volume section. Make sure volume entered matches calibration volume.
- If the volumes are nearly identical (within 15mL), calibration is complete
- If the volumes are off, select the latest calibration run from the table then press Update Meter Factor. Re-calibrate as needed.

The screenshot shows the 'TMS AIS Configuration and Calibration Utility' window. It has a menu bar with 'Configuration', 'Calibration', 'Manual Addition', 'Logs', and 'Help'. The 'Calibration' tab is active. On the left, there are input fields for 'Existing Factor' (0.000651772787318362), 'Measured Volume' (0 Gallons, 0 Liters), 'Flow Rate' (0 Gallons/min), and 'Prover Volume' (20). There are checkboxes for 'Litres' and 'Gallons' (selected), and 'Convert to Gallons' (checked). Below these are buttons for 'Reset', 'Update Meter Factor', and 'Calculate Meter Factor'. In the center, there are two tables: 'Meter' and 'Pump'. The 'Meter' table has columns 'Meter' and 'Meter Factor', with one row showing '1' and '0.0006517727873...'. The 'Pump' table has columns 'Pump' and 'Relay Number', with one row showing '1' and '5'. Below the tables are 'Start' and 'Stop' buttons. On the right, there is a text box that says 'Please select the meter and pump from the list. Press Start when you are ready to start.' At the bottom, there is a table with columns 'Factor(Litres)', 'Factor(...)', 'Measured Volume', 'Prover Volume', and 'Date'. The first row shows '0.00246696', '0.00065...', 'N/A', 'N/A', and '8/5/2020 9'. There is also a 'New Factor' field with the value '0.00246696' and a 'Reset' button.

Meter	Meter Factor
1	0.0006517727873...

Pump	Relay Number
1	5

Factor(Litres)	Factor(...)	Measured Volume	Prover Volume	Date
0.00246696	0.00065...	N/A	N/A	8/5/2020 9



Additive Injection System (AIS)

Manual Additization

- The AIS will automatically compensate additization as needed when a fuel delivery is received. If Manual additization is required, use this feature.
- Select the desired tank from the Tank drop down list.
- If the AIS was actively tracking the tank movements, the proper additive amount will automatically be added to the Additive Amount section.
- If the additive amount needs to be adjusted manually, enter the new additive amount in the Additive Amount section.
- Ensure the Set Blend to 100% is checked. This will ensure the AIS does not attempt to add additional additive during the next fuel delivery and will set the blend to 100% when the stop button is pressed, or the pump is allowed to stop.
- Once all data entered is correct, press the green Start button. This will start the pump and open the appropriate solenoid valve.
- Once complete the pump and valve will automatically close. If you need to stop sooner, press the red Stop button.

TMS AIS Configuration and Calibration Utility

Configuration Calibration Manual Additization Logs Help

For Manual Additization, Select the Tank additive is to be added to, then enter in the additive amount to be dispensed. Ensure the selected pump and meter are correct, changes can be made from the Calibrations page. Once all settings have been verified, press start. The system will automatically stop at the requestd amount. You may press Stop at any time to stop the process.

AIS - Tanks	Tank:	<input type="text"/>
TLSTank ID	Additive Amount:	<input type="text"/>
Additive Ratio	Current Meter:	1
Blend %	Current Pump:	1
	Additive Dispensed:	0 Gallons
TLS - Tanks Data	<input checked="" type="checkbox"/> Set blend to 100%?	
Volume	<input type="button" value="Start"/>	<input type="button" value="Stop"/>
TC Volume		



Additive Injection System (AIS)

Logs

- Use this section to view all the logs generated by the AIS.
- Choose a Start Time and End Time then press Show Logs.
- It may take a few minutes to generate depending on the size of the logs.

The screenshot displays the 'AIS Configuration and Calibration Utility' window with the 'Logs' tab selected. The interface includes a 'Start Time' field set to 'August 05, 2020 00:00:00' and an 'End Time' field with a calendar dropdown for August 2020. A 'Show Logs' button is located to the right of the time fields. The main area contains a table of log entries.

Time	Content
20 12:00:...	TankId 2, siphonId= 1, different in height= 0 feet
20 12:00:...	TankId 1, siphonId= 2, different in height= 0 feet
20 3:06:2...	TankId 2, siphonId= 1, different in height= 0 feet
20 12:01:...	TankId 2, siphonId= 1, different in height= 0 feet
20 12:01:...	TankId 1, siphonId= 2, different in height= 0 feet
8/5/2020 12:02:...	TankId 2, siphonId= 1, different in height= 0 feet
8/5/2020 12:02:...	TankId 1, siphonId= 2, different in height= 0 feet
8/5/2020 6:32:3...	Tank 3 volume not changed for 13
8/5/2020 12:03:...	TankId 2, siphonId= 1, different in height= 0 feet
8/5/2020 6:35:1...	TankId= 2, SalesAve/ minute = 1.2 , SalesVolumefor 5.794 seconds = 0.11588
8/5/2020 12:03:...	TankId 1, siphonId= 2, different in height= 0 feet
8/5/2020 6:35:1...	Tank 2 VolumeNeedInjection = 14
8/5/2020 12:04:...	TankId 2, siphonId= 1, different in height= 0 feet
8/5/2020 6:35:1...	TankId 1, TLSvolume2.tcVolume - TLSvolume1.tcVolume =9, threshold become 3*5.794=17.382
8/5/2020 12:04:...	TankId 1, siphonId= 2, different in height= 0 feet
8/5/2020 6:35:1...	Tank id 1, TLSVol1=24632, Time1=8/5/2020 6:35:09 AM, TLSVol2=24641, Time2=8/5/2020 6:35:14 AM
8/5/2020 12:05:...	TankId 2, siphonId= 1, different in height= 0 feet
8/5/2020 6:32:3...	Tank 1 volume not changed for 1
8/5/2020 6:35:1...	TankId 1, siphonId= 2, different in height= 0 feet
8/5/2020 3:06:2...	TankId 1, siphonId= 2, different in height= 0 feet



Additive Injection System (AIS)

SERVICE

BEFORE SERVICING: ensure that the additive injection system (AIS) “service mode” is ON before servicing ANY components of the system, and ALWAYS use service mode if the TLS system is being serviced.

If service must be performed on the AIS system or any of the mechanical components associated with it, there are some important considerations and procedures that must be followed. Failure to properly follow service procedures can result in injury, product loss, spills, or blending inaccuracies. At all times, care should be taken to minimize or contain all possibility of product spillage through drips or leaks. Service must only be performed by qualified personnel familiar with mechanical fuel systems. More than one person may be required for safe service procedures, such as in situations where confined space entry is required or when remote equipment controls must be activated to run pumps and solenoids. The technician must assess the situation and ensure they are able to perform any service work without risking injury or product loss/spillage.

Procedural consideration

- Always put the system into service mode when service is being performed.
- Never cross-thread any fittings. Cross threading will cause leaks and product loss, as well as irreversibly damaging equipment.
- Any compression-type fittings should be tightened hand tight + $\frac{3}{4}$ turn with the proper tool. NEVER use PTFE-tape or pipe-doping compounds with a compression-type fitting, as it will cause improper seating and will not seal. PTFE-tape or doping-compounds must only be used to secure pipe threads in a standard fitting, and must be selected to meet the requirements of the environment they will be used in.
- For any electrical work or servicing of moving equipment that could pose a safety hazard, proper Lock-Out Tag-Out procedures must be followed. Failure to do so may result in serious injury or death.
- When servicing the tank monitoring system (TLS) it is important to first put the AIS into “Service mode” as described in the Service Mode section. Failure to do so may result in severe over-injection of additive.
- Always isolate product flow before working on any mechanical fuel system components by closing upstream and downstream valves. Always double check and “walk the lines” to visually ensure that there is no possibility of product spills by siphoning or gravity feed.



Additive Injection System (AIS)

AIS Flow Meter Enclosure

It may be necessary to open the AIS Flow Meter enclosure box to adjust the flow valve, if the system is found to be flowing too slow or too fast to accurately measure additive. The flow valve is factory-set by TMS to a default position of 6.5 L/min (1.717 gal/min) and sealed to prevent movement. If the flow valve must be adjusted for troubleshooting, it must be set to no higher than the factory rate of 6.5 L/min.

The AIS Flow Meter within the enclosure is a Badger Meters ¼" NPT threaded oval gear meter. During installation, debris may get lodged in the oval gears. Review Appendix A - Badger Meter Service for additional assembly details. If the meter is found to be inaccurate, and calibration is unable to bring it within acceptable tolerance limits or if the calibration is not repeatable, contact TMS for a replacement meter.

Solenoids

The solenoid valves used in the system are 24VDC Asco Red Hat, normally closed type. If product is found to be bypassing through the solenoid, it may be necessary to remove and service the solenoid body. **Note: removing the solenoid coil from the body stem while it is energized may result in irreparable damage to the coil and can cause a fire hazard. Always ensure the system is in Service Mode before removing solenoids.* When servicing the solenoid stem, make sure to check for ANY debris or metal that could impede movement of the cylinder or damage the plunger seal. Check the outside of the plunger cylinder for scoring or marred surfaces and check the inside of the stem body for any debris or marring. When re-assembling the solenoid body, pay close attention to the orientation and position of the Teflon sealing ring. If the Teflon ring is damaged, the solenoid will not seal correctly. Do not over-tighten the solenoid body and stem assembly, as this may cause thread galling and prevent proper sealing.

Submersible Turbine Pump

If the submersible pump must be serviced or replaced, it is important to make note of the position and height of the pump intake in relation to the tank walls and bottom according to the manufacturer's instructions. The submersible turbine pump must NEVER be operated dry of product or used to pump water. Failure to follow these instructions may cause irreversible damage to the pump.



Additive Injection System (AIS)

Built-in Service Functions

The AIS has 3 built-in functions to aid in diagnosing, troubleshooting, and servicing the system. Mounted inside the AIS panel, on the right-hand side of the enclosure, there are 3 buttons. They are the Check Process, Diagnostics Process, and Service Mode. Each of the built-in processes will display within the AIS Utility window and will also give a printout of the process from the Veeder-Root TLS printer.



Check Button

the check process will test all the outputs of the AIS as well as the pulser and the stop and reset buttons on the front of the panel. During the check process, the AIS will attempt to inject a small quantity of additive into each tank while running the pump, to test solenoid operation. The entire process can be viewed from the AIS Utility window as well as from the TLS ticket printer and monitored for discrepancies.

```
C:\Program Files (x86)\TMS\AISSetup\TMSAdditiveSystem.exe
>>> Checking Gasoline
>>>
>>> Starting pump
>>>
2/28/2019 3:02:05 PM Open pump
>>> * Injecting tank 1 *
>>> Clearing pulser
>>> Pulser reading from
>>> channel 0 = 0
>>>
>>> Solenoid # 1 opened
>>> Solenoid energizing
>>> time delay = 10 mSec
>>>
>>> No pulses
>>>
>>> Closing solenoid
>>> Injected Vol =0
>>> time delay = 1000 mSec
>>> Number of pulses
>>> after closing
>>> solenoid = 0
>>>
>>> Tank injection %
>>> Before = 100
```



Additive Injection System (AIS)

Diagnostics Button

The diagnostics function is used to check the system for active faults, the current blend percentages in each tank, and the injector system status. The diagnostics will print out from the TLS ticket printer and can be used to determine overall system operation.

C:\Program Files (x86)\TMS\AISSetup\TMSAdditiveSystem.exe

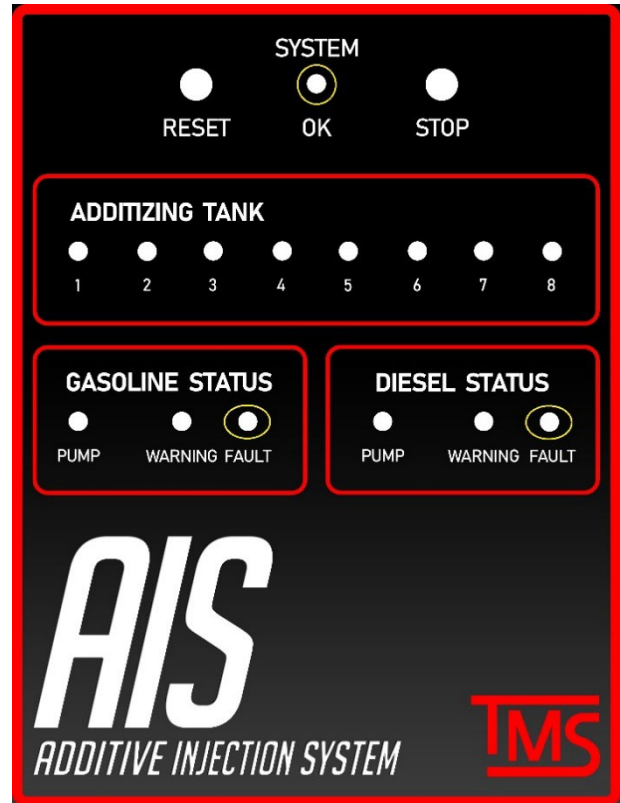
```
>>>
>>>   Diagnostic Ticket
>>>   2/28/2019  2:16:29 PM
>>>
>>>   Active faults:
>>>   Relay board not connected
>>>
>>>   No active warning
>>>
>>>   Tank# 1 T1_Reg
>>>   Additize disabled
>>>   Additive % = 100
>>>
>>>   Tank# 2 T2_Reg
>>>   Additize disabled
>>>   Additive % = 100
>>>
>>>   Tank# 3 T3_Pre
>>>   Additize disabled
>>>   Additive % = 100
>>>
```



Additive Injection System (AIS)

Service Mode Button

The service mode button is used any time that **ANY** of the connected systems must be disconnected for service. Pressing the Service mode button will put the system into service mode, which prevents the AIS from attempting to inject additive or calculate required additive volume. Service mode is indicated by the “System OK” and “Alarm” LEDs on the front of the panel blinking on and off. Service mode is turned off by pressing the reset button, which then returns the system to normal operation. The service mode operation will also print from the TLS printer.





Additive Injection System (AIS)

Examples of Check and Diagnostic tickets printed from the AIS to the TLS printer:

AIS Checking mode
3/5/2019 11:04:26 AM

TLS connected

TMS-450
Is Connected

Diagnostic Ticket
3/5/2019 11:03:34 AM

Relay board
Is connected

Active faults:
Relay board not conn

Pulser board
Is connected

No active warning

Checking Gasoline

Tank# 1 T1_Reg
Additive disabled
Additive % = 54.4

Starting pump

* Injecting tank 1 *
Clearing pulser
Pulser reading from
channel 0 = 0

Tank# 2 T2_Reg
Additive disabled
Additive % = 101.2

Solenoid # 1 opened
Solenoid energizing
time delay = 10 mSec

Tank# 3 T3_Pre
Additive disabled
Additive % = 0

No pulses

Ticket# 1077
Tank Id= 1
Delivery Start
3/5/2019 10:55:51 AM

Closing solenoid
Injected Vol =0
time delay = 1000 mS
Number of pulses
after closing
solenoid = 6

Delivery End
3/5/2019 10:55:51 AM
Vol before: 11641
Vol after: 21700.4
CompenVol: 0
TotalVol 10059.4
Total Addi: 0
%Additive: 54.4

Tank injection %
Before = 54.4
After = 54.4



Additive Injection System (AIS)

Line Purging

Any time the additive line is disconnected from equipment or a section of it is drained of additive, or any time meter service is performed and the flow meter and its lines are drained, the system will need to be purged of air and re-primed before being used to inject more additive into the product storage tanks.

During initial start-up, the meter box must be purged of air using the following steps:

- 1) Close the ball valve downstream of the Flow Meter enclosure leading to the product tanks. This will keep the lines running to each tank primed.
- 2) Place the proving port on the outlet line of the flow meter enclosure into the additive sump riser, or into a large container to hold the additive. Open the ball valve to the proving port while keeping the downstream ball valve leading to the tanks closed.
- 3) Run the pump for **five minutes** to prime the meter and lines leading from the pump and filter.
- 4) Close the proving ball valve and open the downstream valve to allow additive to flow to the product storage tanks.

It may become necessary to purge the additive lines downstream of the meter box due to entrapped air from service or leaks. To do this, start by purging the tank line for the furthest tank first (in relation to the additive sump location) and then the next furthest tank and so on, until all tank lines have been purged. As the tank lines are much longer than the meter lines, they will require a larger volume of additive. **Up to 100 gallons / 375 litres of fuel per tank line must be purged if air is found to be entrapped in the additive piping.** The steps to purge each tank line are as follows:

- 1) Starting at the furthest product tank away from the additive tank, connect a fuel hose from the purge port (type of connection varies based on site installation, contact the site owner for drawings) and run the hose back to the additive tank so that additive will return to storage.
- 2) Ensure all ball valves to other tanks are closed. Only the supply valves and ball valves for the tank line being purged should be open.
- 3) Run the additive pump until additive flows freely from the end of the purge hose.
- 4) Continue to flow additive until approximately 100 gallons have been dispensed.
- 5) Repeat for each tank, until no excess meter flow due to air is detected.
- 6) Drain the additive hose entirely into the additive tank and move to the next line to be purged



Additive Injection System (AIS)

TROUBLESHOOTING & DIAGNOSTICS

The AIS will perform periodic self checks to ensure that all functions are performing correctly. If the issue cannot be automatically corrected, the AIS will indicate the problem with the warning and fault lights on the front of the panel.

SYSTEM OK STATUS

System OK = OFF Warning = ON Fault = ON	Press reset. If the System OK light does not illuminate, there may be a system malfunction. Power down and restart the unit, and call TMS.
System OK = OFF Warning = OFF Fault = ON	System fault has occurred. Press reset to clear. If the fault returns, call TMS. Read printout on ATG for details of fault.
System OK = ON Warning = ON Fault = OFF	Warning condition has occurred, or a fault has occurred with only one product tank. Check ATG printout for details on warning.
System OK = OFF Warning = OFF Fault = OFF	System has no power. Check low voltage disconnect switch, if there is still no power call TMS.



Additive Injection System (AIS)

TROUBLESHOOTING QUICK REFERENCE

When the AIS system encounters a fault, it will print a message on the ATG printer that is networked with the unit, as well as logging and displaying the error message in the program window. The messages that can be printed by the software, as well as the possible causes are as follows:

- **TLS Not Connected**

- This occurs when there is no communication with the VR TLS ATG

Possible Cause	Possible Resolution
Ethernet Cable unplugged or Damaged	Verify cable is seated properly. Verify cable with a tester.
Ethernet Card on TLS not working or Programmed correctly (serial parameters)	Review serial card parameters (Baud rate). Contact Insite360 for specific configuration if needed.
TLS IP not programmed correctly	Review IP address, Subnet Mask and Default Gateway matches IP provide by IT Department.
LAN port on AIS not working	Verify port connectivity with laptop using PING commands. Verify functionality on second LAN port.
LAN port IP on AIS not programmed correctly	Review IP address, Subnet Mask and Default Gateway matches IP provide by IT Department.

- **Relay Board Not Connected**

- This occurs when there is no connection to the internal relay board module

Possible Cause	Possible Resolution
USB cable not seated properly	Reseat USB cable at AIS computer and communication module (black board).
Faulty communication board module (black board)	Gently press on edges of module to ensure it is seated properly in the socket.
Faulty relay board module	Verify there are no loose wires.
Incorrect software configuration	Contact TMS.



Additive Injection System (AIS)

- **Solenoid Failed Closed**

- This occurs when the meter continues to read flow after a solenoid is supposed to be closed.

Possible Cause	Possible Resolution
Faulty Solenoid	Replace solenoid.
Debris stuck in solenoid	Run check procedure a few times or manually open and purge through solenoid.
Incorrect software configuration	Contact TMS.

- **No Pulses**

- This occurs when there are no pulses read from the meter when a check or delivery is called for.

Possible Cause	Possible Resolution
Closed ball valves	Verify ALL ball valves/3-way valves are open/correction position.
Debris stuck in meter	Open meter assembly and verify gears rotate freely.
Meter wired incorrectly	Verify wiring between AIS Meter Box and AIS Controller.
No voltage to solenoids	Measure coil voltage in the AIS and in the Low Voltage Disconnect
Faulty I.S. Barrier	By-pass I.S. to test and replace if needed.

- **E-Stop Pressed**

- This occurs when the E-STOP on the controller is pressed.

Possible Cause	Possible Resolution
E-Stop on controller pressed	Press RESET button on controller.

- **Unknown Error**

- This occurs when the internal logic is incorrect.

Possible Cause	Possible Resolution
Internal logic is incorrect	Contact TMS.



Additive Injection System (AIS)

- **Pulser Board Not Connected**

- This occurs when there is no connection to the internal pulser board module

Possible Cause	Possible Resolution
USB cable not seated properly	Reseat USB cable at AIS computer and pulser board module. (Installed below relay board module)
Incorrect wiring	Verify there are no loose wires.
Incorrect software configuration	Contact TMS.

- **TLS Software Is Not Running**

- This occurs when the TMS TLS utility is not running on the AIS computer.

Possible Cause	Possible Resolution
USB cable not seated properly	Reseat USB cable at AIS computer and communication module (black board).
Faulty communication board module (black board)	Gently press on edges of module to ensure it is seated properly in the socket.
Faulty relay board module	Verify there are no loose wires.
Incorrect software configuration	Contact TMS.

- **Pre-Check Flow Test Failed**

- This occurs when the AIS primes the lines before a Check Process or Fuel Delivery and receives flow from the meter.

Possible Cause	Possible Resolution
Faulty Solenoid	Replace solenoid.
Debris stuck in solenoid	Run check procedure a few times or manually open and purge through solenoid.
Air in the lines	Perform Purge process.
Incorrect software configuration	Contact TMS.



Additive Injection System (AIS)

- **Continuous Flow Test Failed**

- This occurs when the AIS detects flow through the meter when the system should be idle.

Possible Cause	Possible Resolution
Faulty Solenoid	Replace solenoid.
Debris stuck in solenoid	Run check procedure a few times or manually open and purge through solenoid.
Air in the lines	Perform Purge process.
Additive Leak	Verify all sumps and lines for additive leak
Incorrect software configuration	Contact TMS.

- **Volume Variance Check Failed**

- This occurs when the AIS detects a discrepancy between the additive readings from the TLS and AIS Meter.

Possible Cause	Possible Resolution
Faulty Solenoid	Replace solenoid.
Debris stuck in solenoid	Run check procedure a few times or manually open and purge through solenoid.
Air in the lines	Perform Purge process.
Additive Leak	Verify all sumps and lines for additive leak
TLS Probe or Float issue	Verify TLS Probe or Float or working correctly.
Incorrect TLS tank charts	Verify tank strapping charts.
Incorrect software configuration	Contact TMS.

- **TC Volume IS Zero**

- This occurs when the TLS readings return 0 for the TC volumes (Temperature Compensated)

Possible Cause	Possible Resolution
TC Volume not enabled in TLS	Enable TC Volume in TLS. Contact Insite360 for specific configuration if needed.



Additive Injection System (AIS)

- **Minimum Transaction Flow Rate is 0**

- This occurs when the AIS configuration is incorrect which will cause the AIS to see a delivery constantly

Possible Cause	Possible Resolution
TC Volume not enabled in TLS	Enable TC Volume in TLS. Contact Insite360 for specific configuration if needed.

- **Additive over/underblend**

- If the AIS printout and the tank gauge do not reconcile volumes, the CVVC or ATVVC alarms may trigger; calibration is recommended

Possible Cause	Possible Resolution
Additive meter requires recalibration	Recalibrate the additive meter. The meter should be recalibrated once per 2 years.
The tank gauge probe is inaccurate	Ensure the tank probe is correctly installed and sized to the additive tank. Ensure the correct thermal coefficient of expansion is configured for the additive chemical; if unsure, contact the supplier



Additive Injection System (AIS)

CONTACT TMS

For all initial troubleshooting of units and all technical dispatches contact the Veeder-Root Insite-360 team at:

1-800-997-7725

Ask for technical support, and ask the tech for Level 1 support and give your location ID.

If an alarm is present that cannot be cleared and has been deemed to be a Level 3 issue, or if further information on the AIS line of products is required please contact us at:

****Note: A Service Request Number is required when calling TMS.***

Monday to Friday, 8 a.m. to 5 p.m. EST: (416) 225-5867
OR: (416) call TMS option #2
Toll Free: (844) 425-5867

After Hours: (416) 225-5867
OR: (416) call TMS option #2
Toll Free: (844) 425-5867

Note: If calling after hours, please clearly leave your name, telephone number and the nature of your call. A technician will contact you as soon as possible.



Additive Injection System (AIS)

APPENDIX A – BADGER METER SERVICE

When opening the meter, we suggest the following markings of the gears and the housing to ensure the same mounting position as the meter was originally calibrated with.



When opening the meter, the oval gear on the right side is the oval gear with encapsulated magnets inside.

The marking on the housing (red arrow) shows the side where the gear with magnet needs to be placed.





Additive Injection System (AIS)

Oval Gear Meter housing and 2 oval gears.
The oval gear on the right side is the gear with the encapsulated magnets. Here you can see the gear with the magnet and without the magnet. The side with the encapsulated magnet must face the bottom of the housing when mounting it.



Stainless steel bolts to encapsulate the magnets

Position of the stainless-steel bolts facing the bottom when mounting the oval gear.

